

WHAT IS CLAIMED:

1. A method for processing a print job in a rendering device, comprising:
constructing a display list object for a to-be-printed object in said print job; and
5 determining whether any math or logic function of said display list object requires
a hard processing operation.
2. The method of claim 1, further including setting a flag if said any math or logic
function requires said hard processing operations.
- 10 3. The method of claim 1, further including constructing a band display list if said any
math or logic function requires said hard processing operation.
4. The method of claim 1, wherein said determining further includes examining an ink
15 attribute of said display list object.
5. The method of claim 1, further including directly rendering said to-be-printed object
in a device specific page if said any math or logic function does not require said hard
processing.
- 20 6. The method of claim 1, further including constructing a display list root.
7. The method of claim 6, further including constructing a flag attribute of said display
list root that becomes set or not depending upon said determining.
- 25 8. The method of claim 1, further including constructing an ink attribute of said display
list object.
9. The method of claim 1, further including constructing a type attribute and a region
30 attribute of said display list object.

10. A method for processing a to-be-printed page of a print job in a device, said to-be-printed page having a to-be-printed object thereof, comprising:

constructing a display list object for said to-be-printed object; and
determining whether a flag corresponding to said display list object is set or not.

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11. The method of claim 10, further including depending upon if said flag is set or not, one of rendering said to-be-printed object in a device specific page and constructing a band display list for said to-be-printed page.

10 12. The method of claim 10, wherein said determining further includes determining whether a math or logic function of said display list object requires a hard processing operation.

13. The method of claim 12, wherein said determining whether said math or logic
15 function of said display list object requires said hard processing operation further requires examining an ink attribute of said display list object.

14. The method of claim 10, further including constructing a display list root, said display list root containing said flag.

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15. A method for processing a to-be-printed page of a print job in a printer, said to-be-printed page having a plurality of to-be-printed objects thereof, comprising:

constructing a display list object for each of said to-be-printed objects;
determining whether a first flag corresponding to said display list objects is set or

25 not;

depending whether said first flag is set or not, one of rendering said each of said to-be-printed objects in a first device specific page and constructing a plurality of band display lists for said to-be-printed page, said plurality of band display lists including said display list objects;

30 determining whether a second flag corresponding to said plurality of band display lists is set or not; and

depending whether said second flag is set or not, one of rendering said to-be-printed objects in a second device specific page and constructing a contone band.

16. The method of claim 15, wherein said constructing said contone band further
5 includes blending color information in a first color space.

17. The method of claim 16, further including converting said color information into a second color space of said printer.

10 18. The method of claim 15, further including receiving an indication that all of said to-be-printed objects of said to-be-printed page have been presented to said printer.

19. A method for processing a print job in a printer, comprising:

constructing a display list object for a to-be-printed object in said print job;
15 setting a first flag or not corresponding to a first condition of said display list object;
constructing a band display list for a to-be-printed page of said print job;
setting a second flag or not corresponding to a second condition of said band display list, said first and second flags being one of the same and different;
20 constructing a contone page for use in blending color information in a color space of a host device connected to said printer; and
rendering said to-be-printed object in a device specific page of memory.

20. A method of processing a to-be-printed page of a print job in a device, said to-be-printed page having a plurality of to-be-printed objects thereof, comprising:

25 constructing a display list object for said to-be-printed object, a band display list for a band of said to-be-printed page and a contone band;
setting a flag or not corresponding to a condition of one of said display list object and said band display list;
30 blending color information of overlapping pixels of said plurality of to-be-printed objects, said blending occurring in creating said contone band; and

rendering said contone band in a device specific band in memory of said device.

21. The method of claim 20, wherein said setting further includes examining an ink attribute of said display list object.

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22. The method of claim 21, wherein said examining further includes determining whether a math or logic function of said ink attribute requires a hard processing operation.

10 23. The method of claim 20, wherein said blending further includes constructing a contone page.

24. The method of claim 23, wherein said blending further includes blending color information of a pixel of said to-be-printed object with a pixel of said contone page to
15 create a pixel of resultant color information.

25. The method of claim 24, wherein said rendering further includes converting said resultant color information into a color space of said device.

20 26. A method for processing a to-be-printed page of a print job in a printer, said to-be-printed page having a plurality of to-be-printed objects thereof, comprising:

receiving an indication that all of said to-be-printed objects have been presented;

constructing a display list object for said all of said to-be-printed objects, said display list object including an ink attribute having a math or logic function for said all
25 said to-be-printed objects;

determining whether any said math or logic function requires hard processing operations or not;

dividing said to-be-printed page into a plurality of bands;

determining which of said plurality of bands contain said to-be-printed objects
30 therein;

constructing a band display list for each of said plurality of bands containing said to-be-printed objects, said each said band display list including at least one of said display list objects;

5 determining in said each said band display list whether said any math or logic functions require said hard processing operations or not;

constructing a contone page having pixels corresponding to color information of pixels of said to-be-printed page;

blending color information of one of said pixels of said contone page with a pixel of one of said to-be-printed objects to create a pixel of resultant color information; and

10 rendering said all said to-be-printed objects in a device specific page in memory of said printer.

27. A method for processing a print job in a device, comprising:

dividing a to-be-printed page of said print job into a plurality of bands;

15 constructing a band display list for said plurality of bands containing a to-be-printed object of said to-be-printed page therein; and

determining whether a math or logic function of any of said band display lists requires a hard processing operation.

20 28. The method of claim 27, further including setting a flag if said math or logic function requires said hard processing operations.

29. The method of claim 27, further including constructing a display list object for said to-be-printed object.

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30. The method of claim 29, wherein said determining further includes examining an ink attribute of said display list object.

31. The method of claim 27, further including directly rendering said to-be-printed object in a device specific page if said math or logic function does not require said hard processing.

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32. The method of claim 27, further including constructing an overall band display list for each said band display list constructed.

5 33. The method of claim 32, further including one of linking said each said band display list together in a memory of said device and blocking said each said band display list together in a contiguous fashion in said memory.

34. The method of claim 27, further including constructing a flag attribute for each of
10 said band display lists that become constructed.

35. A method for processing a to-be-printed page of a print job in a device, said to-be-printed page having a to-be-printed object thereof, comprising:

dividing said to-be-printed page of said print job into a plurality of bands;
15 constructing a band display list for said plurality of bands that contain said to-be-printed object therein; and
determining whether a flag corresponding to said constructed band display lists is set or not.

20 36. The method of claim 35, depending upon if said flag is set or not, one of rendering said to-be-printed object in a device specific page and constructing a contone band for color information of said to-be-printed object.

37. The method of claim 35, wherein said determining further includes examining
25 whether a math or logic function of said constructed band display list requires a hard processing operation.

38. The method of claim 35, further including constructing a display list object for said to-be-printed object.

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39. The method of claim 38, further including constructing an ink attribute for said display list object.

40. The method of claim 39, wherein said determining further includes examining whether a math or logic function of said ink attribute requires a hard processing operation.

41. The method of claim 35, further including constructing a flag attribute for each of said band display lists that become constructed.

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42. A method for processing a to-be-printed page of a print job in a device, said to-be-printed page having a plurality of to-be-printed objects thereof, comprising:

dividing said to-be-printed page of said print job into a plurality of bands;

15 constructing a contone page for color information of said to-be-printed page, said color information being in a first color space;

on a band-by-band basis, blending color information of said to-be-printed objects with said color information of said contone page to create a plurality of contone bands.

43. The method of claim 42, further including on said band-by-band basis, blending color information of one of said to-be-printed objects with another of said to-be-printed objects.

44. The method of claim 42, further including converting color information of said contone bands into a second color space of said device.

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45. The method of claim 44, further including performing a halftone operation.

46. The method of claim 42, further including rendering said to-be-printed objects into a device specific page in a memory of said device.

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47. The method of claim 42, further including freeing memory locations for said contone bands.

48. The method of claim 42, further including constructing a band display list for each
5 said plurality of bands that contain said to-be-printed objects therein.

49. The method of claim 48, further including determining whether a flag corresponding to said constructed band display lists is set or not.

10 50. The method of claim 49, further including constructing a display list object for each said plurality of to-be-printed objects.

51. The method of claim 50, further including determining whether a math or logic function of an ink attribute of said constructed display list objects requires a hard
15 processing operation.

52. A method for processing a to-be-printed page of a print job in a device, said to-be-printed page having a plurality of to-be-printed objects thereof, comprising:

dividing said to-be-printed page of said print job into a plurality of bands;
20 for at least one of said bands, constructing a contone band for blended color information of overlapping pixels of said to-be-printed objects, said blended color information being in a first color space.

53. The method of claim 52, wherein said constructing further includes constructing a
25 contone page for color information of said to-be-printed page.

54. The method of claim 53, wherein said constructing said contone band further includes blending pixels of said contone page with pixels of one of said to-be-printed objects.

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55. The method of claim 52, further including rendering said to-be-printed objects into a device specific page in memory of said device, said device specific page being in a second color space different than said first color space.

5 56. The method of claim 55, further including freeing memory locations corresponding to said contone band.

57. The method of claim 52, further including constructing a band display list for each said plurality of bands that contain said to-be-printed objects therein.

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58. The method of claim 57, further including determining whether a flag corresponding to said constructed band display lists is set or not.

15 59. The method of claim 52, further including constructing a display list object for each said plurality of to-be-printed objects.

60. The method of claim 59, further including determining whether a math or logic function of an ink attribute of said constructed display list objects requires a hard processing operation.

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61. A computer readable media for use with a host device, said media including computer executable instructions for processing a to-be-printed page of a print job of said host device, said to-be-printed page having a plurality of to-be-printed objects thereof, said computer executable instructions for performing the steps comprising:

25 determining whether any math or logic function associated with any of said to-be-printed objects requires a hard processing operation.

62. The media of claim 61, further including computer executable instructions for setting a flag or not depending upon said determining.

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63. The media of claim 61, further including computer executable instructions for constructing a display list object for all said to-be-printed objects.

5 64. The media of claim 61, further including computer executable instructions for constructing a band display list for any band of said to-be-printed page having one of said to-be-printed objects therein.

65. The media of claim 61, further including computer executable instructions for constructing a contone page for color information of said to-be-printed page.

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66. The media of claim 61, further including computer executable instructions for rendering all of said to-be-printed objects in a device specific page in memory of one of said host device and a printer connected thereto, the media residing in one of the host device and the printer.

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67. The media of claim 61, further including computer executable instructions for blending color information of overlapping pixels of said plurality of to-be-printed objects to create a contone band.

20 68. The media of claim 61, further including computer executable instructions for dividing said to-be-printed page into a plurality of bands and rendering all of said to-be-printed objects in a device specific page in memory of one of the host device and a printer connected thereto, said rendering occurring on a band-by-band basis.

25 69. The media of claim 61, further including computer executable instructions for constructing a contone page for color information of said to-be-printed page and blending color information of pixels of one of said plurality of to-be-printed objects with pixels of said contone page to create a contone band.

30 70. A computer readable media having computer executable instructions for processing a to-be-printed page of a print job, said to-be-printed page having a plurality of to-be-

printed objects thereof, said computer executable instructions for performing the steps comprising:

receiving an indication that all of said to-be-printed objects have been presented;
constructing a display list object for all said to-be-printed objects, all said display
5 list objects having an ink attribute;

constructing a band display list for any band of said to-be-printed page having one
of said to-be-printed objects therein, said constructed band display lists including one or
more said constructed display list objects;

10 setting a flag or not corresponding to whether any math function associated with
any of said ink attributes requires a hard processing operation;

in a first color space, blending color information of overlapping pixels of said
plurality of to-be-printed objects to create a contone band; and

rendering said plurality of to-be-printed objects into a device specific page in a
memory, said device specific page being in a second color space.

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71. A method for processing a PDL print job in a device, said PDL print job having at
least one to-be-printed object, comprising determining whether a math or logic function
specified by said PDL print job for said at least one to-be-printed object requires a hard
processing operation.

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72. The method of claim 71, wherein said determining further includes examining said
math or logic function for two or more inputs.

73. The method of claim 71, wherein said determining further includes assessing
25 whether said math or logic function includes a Boolean expression.

74. The method of claim 71, wherein said determining further includes assessing
whether said math or logic function includes an algebraic equation.

30 75. The method of claim 71, further including constructing a display list object for said
at least one to be printed object.

76. The method of claim 75, further including constructing an ink attribute of said display list object, said math or logic function residing in said ink attribute.

5 77. The method of claim 75, further including constructing a band display list having said display list object.

78. The method of claim 77, further including constructing an ink attribute of said display list object, said math or logic function residing in said ink attribute.

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79. The method of claim 71, further including setting a flag or not depending upon said determining.

80. The method of claim 71, further including constructing a contone page for color information of a to-be-printed page of said print job, said color information being in a first color space different than a second color space of said device.

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81. The method of claim 80, further including blending color information of a pixel of said at least one to-be-printed object with said color information of a pixel of said contone page to create a pixel of resultant color information.

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82. The method of claim 81, further including blending said pixel of resultant color information with color information of a pixel of a second to-be-printed object to create a pixel of second resultant color information.

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83. The method of claim 82, further including converting said pixel of second resultant color information into said second color space.

84. The method of claim 81, further including converting said pixel of resultant color information into said second color space.

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85. The method of claim 84, further including, in said device, freeing memory locations containing said pixel of resultant color information.

5 86. A computer readable media having computer executable instructions for performing the steps recited in claim 85.

87. A computer readable media having computer executable instructions for performing the steps recited in claim 83.

10 88. A method for processing a PCL print job in a device, said PCL print job having at least one to-be-printed object, comprising determining whether one of about 256 possible logic functions specifiable by said PCL print job for said at least one to-be-printed object requires a hard processing operation.

15 89. The method of claim 88, wherein said determining further includes examining said one logic function for two or more inputs.

20 90. The method of claim 88, further including receiving an indication from said PCL print job that said at least one to-be-printed object has been presented to said device.

91. The method of claim 88, further including constructing a display list object for said at least one to be printed object.

25 92. The method of claim 91, further including constructing an ink attribute of said display list object, said one math or logic function residing in said ink attribute.

30 93. The method of claim 92, further including constructing a band display list for any band of a to-be-printed page of said print job having said at least one to-be-printed object therein, said constructed band display list including said display list object.

94. The method of claim 93, further including setting a flag or not depending upon said determining, said flag residing in one of said display list object and said band display list.

5 95. The method of claim 94, further including constructing a contone page for color information of said to-be-printed page, said color information being in a first color space different from a second color space of said device.

10 96. The method of claim 95, further including, on a band-by-band basis of said plurality of bands, blending color information of a pixel of said at least one to-be-printed object with said color information of a pixel of said contone page to create a pixel of resultant color information.

15 97. The method of claim 96, further rendering said at least one to-be-printed object in a device specific page in memory of said device, said device specific page being in said second color space.

98. The method of claim 97, further including freeing memory locations containing said pixel of resultant color information.

20 99. A computer readable media having computer executable instructions for performing the steps recited in claim 98.

25 100. A printer having a graphics engine with computer executable instructions stored in a memory accessible by the graphics engine for performing the steps recited in claim 98.

101. A method for processing a PDF print job in a device, said PDF print job having at least one to-be-printed object, comprising determining whether one of about 16 possible math or logic functions specifiable by said PDF print job for said at least one to-be-printed object requires a hard processing operation.

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